What Works Clearinghouse

INSTITUTE OF EDUCATION SCIENCES

Early Childhood Education July 23, 2007

SRA Real Math Building Blocks PreK

Program description[1]

SRA Real Math Building Blocks PreK (also referred to as *Building Blocks for Math*) is a supplemental mathematics curriculum designed to develop preschool children's early mathematical knowledge through various individual and small- and large-group activities. It uses *Building Blocks for Math PreK* software, manipulatives, and print material. *Building Blocks for Math* embeds mathematical learning in children's daily activities, ranging from designated math activities to circle and story time, with the goal of helping children relate their informal math knowledge to more formal mathematical concepts.

Research

Two studies of *Building Blocks for Math* met the What Works Clearinghouse (WWC) evidence standards.[2] They included over 250 preschool children from New York State. This report focuses on immediate posttest findings to determine the effectiveness of the intervention.[3] The WWC considers the extent of evidence for *Building Blocks for Math* to be small for mathematics achievement. No studies that met WWC evidence standards with or without reservations addressed oral language, print knowledge, phonological processing, early reading/writing, or cognition.

Effectiveness

Building Blocks for Math was found to have positive effects on mathematics achievement.

	Oral language	Print knowledge	Phonological processing	Early reading/ writing	Cognition	Math
Rating of effectiveness	na	na	na	na	na	Positive Effects
Improvement index[4]	na	na	na	na	na	Average: +36 percentile points Range: +27 to +42 percentile points

na = not applicable

1. The descriptive information for this program was obtained from publicly available sources: the research literature (Clements & Sarama, 2006, June; Clements & Sarama, 2007; Clements & Sarama, 2002; Clements & Sarama, n.d.; Sarama & Clements, 2003), and the program description provided by the author upon the WWC request. The WWC requests developers to review the program description sections for accuracy from their perspective. Further verification of the accuracy of the descriptive information for this program is beyond the scope of this review.
2. To be eligible for the WWC's review, the Early Childhood Education (ECE) intervention had to be implemented in English in center-based settings with children aged three to five or in preschool.
3. The evidence presented in this report is based on available research. Findings and conclusions may change as new research becomes available.
4. These numbers show the average and range of student-level improvement indices for all findings across the studies.

Additional program information[1]

Developer and contact

Building Blocks for Math was developed by Drs. Douglas Clements and Julie Sarama and is available for preview by contacting the developers. Address: Graduate School of Education, University at Buffalo, The State University of New York, Buffalo, NY 14260. Email: clements@buffalo.edu or jsarama@buffalo.edu. Web: http://www.gse.buffalo.edu/org/buildingblocks/. Telephone: (716) 645-2455 Ext. 1155. It is distributed by SRA/McGraw-Hill; contact Rick Rikhoff, Director of Marketing Services. Email: rick_rikhoff@mcgraw-hill.com. Telephone: (614) 750-7264.

Scope of use

A year after the curriculum was released in 2006, there were 23,000 children in 51 schools across the nation who purchased *Building Blocks for Math*. In several documented research projects, *Building Blocks for Math* has been implemented by additional preschool and childcare programs in New York (more than 100 classrooms), Massachusetts (more than 60 classrooms), and Nashville (more than 50 classrooms). These programs include children from low- and mixed-income families.

Teaching

The *Building Blocks for Math* materials integrate three types of media: software, manipulatives (and everyday objects), and print materials (e.g., books). The materials are designed to be used in a variety of environments: home, day care, and classroom. *Building Blocks for Math* integrates computer activities *(DLM Express)* with other activities like teaching games and free-choice learning centers. The curriculum is structured around empirically based learning trajectories (i.e., what is appropriate for children at that age in terms of mathematics). The curriculum includes whole- and small-group activities and games, free-choice learning centers, ideas for integrating mathematics throughout the school day, computer software, and books, game sheets, and manipulatives. Activities are designed so they are based on children's experiences and interests because the program aims to "mathematize" their everyday activities, including building blocks, art, songs, stories, and puzzles. The software includes 150 activities (60 are intended for preschoolers). The *Building Blocks for Math* materials emphasize mathematical actions-on-objects, such as solving a sequence of geometric puzzles by filling outlines with pattern blocks.

Teaching guidance is provided for both off- and on-computer activities in the teachers' materials. The software's management system presents tasks, contingent on success along research-based trajectories that are sequenced according to children's developmental progression.

Cost

Costs for curriculum materials, teacher resources, and software are:

- Real Math Teacher Edition, Pre-K costs $198
- Real Math Teacher Resource Book, Pre-K costs $129
- Real Math Assessment Booklet, Pre-K costs $78
- Real Math Pre-K Big Books (*The Shape of Things, I Spy Two Eyes, The Right Number of Elephants,* and *Bat Jamboree*) each cost $58
- Real Math Pre-K Manipulative Kit costs $282
- SRA Math *Building Blocks for Math* online costs $10 per student per year

Research

Three studies reviewed by the WWC investigated the effects of *Building Blocks for Math* in center-based settings. Two studies (Clements & Sarama, 2006; Clements & Sarama, 2007) were randomized controlled trials that met WWC evidence standards. The remaining study did not meet WWC evidence screens.

Clements and Sarama (2006) included 28 preschool teachers (202 children) from low- to mixed-income families in New York State and compared math outcomes for children participating in a *Building Blocks for Math* intervention group to a business-as-usual comparison group.[5]

Clements and Sarama (2007) included four preschool teachers (53 children) from low-income families in New York State and compared math outcomes for children who participated in a *Building Blocks for Math* group to a business-as-usual comparison group.

Extent of evidence

The WWC categorizes the extent of evidence in each domain as small or moderate to large (see the What Works Clearinghouse Extent of Evidence Categorization Scheme). The extent of evidence takes into account the number of studies and the total sample size across the studies that met WWC evidence standards with or without reservations.[6]

The WWC considers the extent of evidence for *Building Blocks for Math* to be small for mathematics achievement. No studies that met WWC evidence standards with or without reservations addressed oral language, print knowledge, phonological processing, early reading/writing, or cognition.

Effectiveness

Findings

The WWC review of interventions for early childhood education addresses children's outcomes in six domains: oral language, print knowledge, phonological processing, early reading/writing, cognition, and math. Clements and Sarama (2006, 2007) addressed outcomes in the math domain. The findings below present the authors' and the WWC-calculated estimates of the size and statistical significance of the effects of *Building Blocks for Math* on children's performance.[7]

Math. Clements and Sarama (2006) analyzed group differences between the *Building Blocks for Math* intervention group and the business-as-usual comparison group on one math outcome measure (Early Mathematics Assessment). The difference between groups was statistically significant and favored children in the *Building Blocks for Math* group.

Clements and Sarama (2007) found a statistically significant difference favoring children in the *Building Blocks for Math* group on one of the two outcome measures assessed in this domain (Building Blocks Assessment of Early Mathematics, PreK–K: Geometry section) and this effect was confirmed to be statistically significant by the WWC. The authors also reported statistically significant differences between the intervention and business-as-usual comparison groups on the other math measure (Building Blocks Assessment of Early Mathematics, PreK–K:

5. The study also included a *Pre-K Mathematics* intervention group, which used *DLM Express* as an additional component. The study authors labeled the *Pre-K Mathematics* group as the "comparison group" and the *Building Blocks for Math* group as the "intervention group"; however, the WWC considers *Pre-K Mathematics* as a separate intervention (see the separate WWC Pre-K Mathematics intervention report). For the rating of effectiveness in this WWC intervention report, the WWC includes only the results comparing the *Building Blocks for Math* group to the business-as-usual comparison group; however, results for the comparison between the curricula are included in a separate section of this report and in Appendix A4.
6. The Extent of Evidence Categorization was developed to tell readers how much evidence was used to determine the intervention rating, focusing on the number and size of studies. Additional factors associated with a related concept, external validity, such as the students' demographics and the types of settings in which studies took place, are not taken into account for the categorization.
7. The level of statistical significance was reported by the study authors or, where necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For an explanation, see the WWC Tutorial on Mismatch. See the Technical Details of WWC-Conducted Computations for the formulas the WWC used to calculate the statistical significance. In the case of *Building Blocks for Math,* corrections for clustering and multiple comparisons were needed.

Effectiveness *(continued)*

Number section); however, the WWC was unable to confirm the statistical significance of this effect.

Rating of effectiveness

The WWC rates the effects of an intervention in a given outcome domain as positive, potentially positive, mixed, no discernible effects, potentially negative, or negative. The rating of effectiveness takes into account four factors: the quality of the research design, the statistical significance of the findings,[7] the size of the difference between participants in the intervention and the comparison conditions, and the consistency in findings across studies (see the WWC Intervention Rating Scheme).

The WWC found *Building Blocks for Math* to have positive effects on math

Improvement index

The WWC computes an improvement index for each individual finding. In addition, within each outcome domain, the WWC computes an average improvement index for each study and an average improvement index across studies (see Technical Details of WWC-Conducted Computations). The improvement index represents the difference between the percentile rank of the average student in the intervention condition versus the percentile rank of the average student in the comparison condition. Unlike the rating of effectiveness, the improvement index is based entirely on the size of the effect, regardless of the statistical significance of the effect, the study design, or the analyses. The improvement index can take on values between –50 and +50, with positive numbers denoting results favorable to the intervention group.

The average improvement index for math is +36 percentile points across the two studies, with a range of +27 to +42 percentile points across findings.

Findings for comparisons between *Building Blocks for Math* and *Pre-K Mathematics*

The analysis for the comparison described below was included in the Clements and Sarama (2006) study, but the findings do not contribute to the overall rating of effectiveness because the WWC used the comparison of *Building Blocks for Math* to the business-as-usual comparison group from the same study in the rating, which provides a clearer sense of *Building Blocks for Math's* effects. However, the WWC believes that the findings from this comparison provide useful information to practitioners who may be interested in comparing the effects of different curricula. The WWC reports the findings for comparisons of *Building Blocks for Math* and *Pre-K Mathematics* here and in Appendix A4.

Math. Clements and Sarama (2006) analyzed group differences between the *Building Blocks for Math* group and the *Pre-K Mathematics* combined with *DLM Express* group for one math outcome measure (Early Mathematics Assessment). The difference between groups was statistically significant and favored children in the *Building Blocks for Math* group. The improvement index for math is +19 percentile points (*Building Blocks for Math* is the intervention group and *Pre-K Mathematics* is the comparison group) for the single finding in the study.

Summary

The WWC reviewed three studies on *Building Blocks for Math*. Two of these studies met WWC evidence standards; the remaining study did not meet WWC evidence screens. Based on these two studies, the WWC found positive effects for math. Additional findings that were not considered for the rating of effectiveness indicated that *Building Blocks for Math* may have a larger impact on children's math outcomes than another skills-focused preschool mathematics intervention. The evidence presented in this report may change as new research emerges.

References

Met WWC evidence standards

Clements, D. H., & Sarama, J. (2006, June). *Scaling up the implementation of a pre-Kindergarten mathematics curriculum: The Building Blocks curriculum.* Paper presented at the Institute of Education Sciences Research Conference, Washington, D.C.

Clements, D. H., & Sarama, J. (2007). Effects of a preschool mathematics curriculum: Summative research on the Building Blocks project. *Journal for Research in Mathematics Education, 38*(2), 136–163.

Additional sources:

Clements, D. H., & Sarama, J. (2002). *Effects of a preschool mathematics curriculum: Research on the NSF-funded Building Blocks Project.* University at Buffalo, State University of New York.

Clements, D. H., & Sarama, J. (n.d.). *Effects of a preschool mathematics curriculum: Summary research on the NSF-funded Building Blocks project.* University at Buffalo, State University of New York. Retrieved from http://www.gse.buffalo.edu/org/buildingblocks/writings/Building%20Blocks%20Research%201.pdf

Did not meet WWC evidence screens

Sarama, J., & Clements, D. H. (2003). Building Blocks of early childhood mathematics. *Teaching Children Mathematics, 9*(8), 480-484.[8]

For more information about specific studies and WWC calculations, please see the WWC *Building Blocks for Math* Technical Appendices.

8. The study did not use a comparison group.

Appendix

Appendix A1.1 Study characteristics: Clements & Sarama, 2006 (randomized controlled trial)

Characteristic	Description
Study citation	Clements, D. H., & Sarama, J. (2006, June). *Scaling up the implementation of a pre-Kindergarten mathematics curriculum: The Building Blocks curriculum.* Paper presented at the Institute of Education Sciences Research Conference, Washington, D.C.
Participants	Teachers were randomly assigned to conditions in two separate steps. Twenty-four teachers from preschool programs serving low-income children were randomly assigned to two intervention groups (*Building Blocks for Math* or *Pre-K Mathematics*)[1] or a business-as-usual comparison group. Twelve teachers from preschool programs serving mixed-income children were randomly assigned to the *Building Blocks for Math* group or the business-as-usual comparison group. Consequently there were a total of 14 teachers in the *Building Blocks for Math* group and 14 teachers in the business-as-usual comparison group. Eight preschool-age children were randomly selected from each classroom for assessment (N = 224).[2] After attrition, the final sample included 28 teachers and 202 children (14 teachers and 101 children in the *Building Blocks for Math* group; 14 teachers and 101 children in the business-as-usual comparison group).
Setting	The study was conducted in Head Start and state-funded preschool programs in New York State.
Intervention	Children in the *Building Blocks for Math* intervention condition used the *Building Blocks for Math* curriculum in 10- to 15-minute small-group (4–6 children) math activities weekly. These children also participated in 5- to 15-minute whole-group math activities four times a week and 5- to 10-minute computer activities *(DLM Express)* twice a week. Related family activities were sent home weekly. The intervention lasted for 26 weeks, and intervention teachers maintained their daily activities and schedule while inserting mathematics activities at appropriate times during the day.[3]
Comparison	Children in the business-as-usual comparison group participated in their regular daily activities and schedule, with emphasis on small groups and computer activities. These included city-wide math activities, *Creative Curriculum*, Montessori math activities, or “home-grown” math materials based on state standards.
Primary outcomes and measurement	The primary outcome domain assessed was math and it was measured with the Early Mathematics Assessment (see Appendix A2 for a more detailed description of the outcome measure). The study authors also assessed implementation fidelity with the Fidelity of Implementation measure and the quality of the mathematics environment using the Classroom Observation of Early Mathematics Environment and Teaching. This WWC review does not include the results from these observations in this WWC review.[4]
Teacher training	Professional development activities for teachers in the *Building Blocks for Math* group consisted of four days of training, a monthly two-hour class, and monthly in-class coaching by project staff. Teacher training covered a number of topics such as supporting mathematical development in the classroom, recognizing and supporting mathematics throughout the day, setting up mathematics learning centers, teaching with computers, small-group activities, and supporting mathematical development in the home. Learning trajectories were emphasized in the *Building Blocks for Math* training via a web-based application called *Building Blocks Learning Trajectories*.

1. The study also included a *Pre-K Mathematics* intervention group, which used *DLM Express* as an additional component. The study authors labeled the *Pre-K Mathematics* group as the “comparison group” and the *Building Blocks for Math* group as the “intervention group”; however, the WWC considers *Pre-K Mathematics* as a separate intervention (see the separate WWC *Pre-K Mathematics* intervention report). For the rating of effectiveness in this WWC intervention report, the WWC includes only the results comparing the *Building Blocks for Math* group to the business-as-usual comparison group; however, results for the comparison between the curricula are included in Appendix A4.
2. The remaining eight teachers were assigned to the *Pre-K Mathematics* group, which is not the main focus of this WWC intervention report.
3. Children in the *Pre-K Mathematics* intervention group participated in 15- to 20-minute small-group activities at least twice a week and 10- to 15-minute whole-class math activities once a week. In addition, these classrooms used *DLM Express* software for 5 to 10 minutes twice a week. Weekly letters were sent to parents that included math activities similar to those children were learning at school. The intervention lasted for 26 weeks and the teachers maintained their daily activities and schedule while inserting mathematics activities at appropriate times during the day.
4. For further details about the outcomes included in the Early Childhood Education topic review, please see the Early Childhood Education Protocol.

Appendix A1.2 Study characteristics: Clements & Sarama, 2007 (randomized controlled trial)[1]

Characteristic	Description
Study citation	Clements, D. H., & Sarama, J. (2007). Effects of a preschool mathematics curriculum: Summative research on the Building Blocks project. *Journal for Research in Mathematics Education, 38*(2), 136–163. *Additional sources:* Clements, D. H., & Sarama, J. (2002). *Effects of a preschool mathematics curriculum: Research on the NSF-funded Building Blocks Project.* University at Buffalo, State University of New York. Clements, D. H., & Sarama, J. (n.d.). *Effects of a preschool mathematics curriculum: Summary research on the NSF-funded Building Blocks project.* University at Buffalo, State University of New York. Retrieved from http://www.gse.buffalo.edu/org/buildingblocks/writings/Building%20Blocks%20Research%201.pdf
Participants	Two teachers from a Head Start center and two teachers from a state-funded preschool program were randomly assigned to the *Building Blocks for Math* group or the business-as-usual comparison group. There were 77 children in the four classrooms; however, nine children left the classrooms during the course of the study. Final analysis samples ranged from 53 to 61 children.[1] The majority of the children were from low-income families. The mean age of the children was 49.9 months, and 49% of the children were female.
Setting	The study took place in one Head Start and one state-funded preschool program in New York State.
Intervention	The intervention group used *Building Blocks for Math* for 25 weeks. *Building Blocks for Math* includes whole- and small-group activities and games, free-choice learning centers, ideas for integrating mathematics throughout the school day, computer software *(DLM Express)*, and books, game sheets, and manipulatives. Teachers in the state-funded preschool program implemented the curriculum with a high degree of fidelity, whereas teachers in the Head Start center implemented it with a moderate—but adequate—degree of fidelity.
Comparison	Children in the business-as-usual comparison group used their typical preschool math curricula and activities over the same 25 weeks. The typical preschool math curriculum used in the Head Start comparison classroom was *Creative Curriculum* and math activities developed by the program. The state-funded preschool program comparison classroom continued implementing the school's regular math curriculum.
Primary outcomes and measurement	The primary outcome domain assessed was math, and it was measured with the Number and Geometry sections of the Building Blocks Assessment of Early Mathematics, PreK–K (see Appendix A2 for more detailed descriptions of outcome measures).
Teacher training[2]	Intervention teachers participated with researchers in a half-day review of curriculum materials. Project staff observed intervention teachers implementing the curriculum and were available to answer questions and discuss implementation issues with teachers as needed.

1. According to data provided by the study authors upon the WWC request, there was within-cluster attrition of 21.6% between the intervention (10% of children) and business-as-usual comparison (31.6% of children) groups. However, the WWC did not downgrade the study because there was pretest equivalence between groups for the non-attritors.
2. The study authors had worked previously with the teachers at the stated-funded preschool program, the intervention teacher at the Head Start was inexperienced, and the comparison teacher at Head Start had taught Head Start for eight years.

Appendix A2 Outcome measures in the math domain[1]

Outcome measure	Description
Early Mathematics Assessment	A researcher-developed measure that uses two individual child interviews to assess young children's mathematical knowledge and skills in the areas of number, geometry, measurement, and patterning (as cited in Clements & Sarama, 2006).
Building Blocks Assessment of Early Mathematics, PreK–K: Number section	A researcher-developed measure that uses individual child interviews to assess young children's mathematical knowledge. The number section measures nine topics, including verbal counting, object counting, number recognition, number comparison, number sequencing, numerals, number composition, adding and subtracting, and place value (as cited in Clements & Sarama, 2007).
Building Blocks Assessment of Early Mathematics, PreK–K: Geometry section	A researcher-developed measure that uses individual child interviews to assess young children's mathematical knowledge. The geometry section measures seven topics, including shape identification, shape composition, congruence, construction of shape, turns, measurement, and patterning (as cited in Clements & Sarama, 2007).

1. The Early Mathematics Assessment is an earlier version of the Building Blocks Assessment of Early Mathematics. The name change was at the publisher's request.

Appendix A3 Summary of study findings included in the rating for the math domain[1]

			Authors' findings from the study		WWC calculations			
			Mean outcome (standard deviation[2])					
Outcome measure	Study sample	Sample size (teachers/children)[3]	*Building Blocks for Math* group[4]	Comparison group[4]	Mean difference[5] (*Building Blocks for Math* – comparison)	Effect size[6]	Statistical significance[7] (at $\alpha = 0.05$)	Improvement index[8]
Clements & Sarama, 2006 (randomized controlled trial)[9]								
Early Mathematics Assessment	Preschool children	28/202	61.69 (7.46)	53.22 (8.38)	8.47	1.06	Statistically significant	+36
Average[10] for math (Clements & Sarama, 2006)						1.06	Statistically significant	+36
Clements & Sarama, 2007 (randomized controlled trial)[11]								
BBA: Number section	4 year olds	4/61	28.23 (14.47)	17.93 (12.48)	10.30	0.75	ns	+27
BBA: Geometry section	4 year olds	4/53	15.75 (3.81)	10.64 (3.35)	5.11	1.40	Statistically significant	+42
Average[10] for math (Clements & Sarama, 2007)						1.08	Statistically significant	+36
Domain average[10] for math across all studies						1.07	na	+36

BBA = Building Blocks Assessment of Early Mathematics, PreK–K
ns = not statistically significant
na = not applicable

1. This appendix reports findings considered for the effectiveness rating and the average improvement indices. Findings from the head-to-head comparison of *Building Blocks for Math* to *Pre-K Mathematics* from Clements and Sarama (2006) are not included in these ratings, but are reported in Appendix A4.
2. The standard deviation across all students in each group shows how dispersed the participants' outcomes are: a smaller standard deviation on a given measure would indicate that participants had more similar outcomes. The standard deviations for Clements and Sarama (2006) were provided by the study authors upon WWC request.
3. The child-level sample sizes were provided by the study authors upon WWC request.
4. For Clements and Sarama (2006), the intervention group mean (61.69) equals the comparison group mean (53.22) plus the program coefficient from the author-conducted HLM analysis (8.47). For Clements and Sarama (2007), the intervention group mean equals the comparison group mean plus the mean difference.
5. Positive differences and effect sizes favor the intervention group; negative differences and effect sizes favor the comparison group. For Clements and Sarama (2006), the mean difference was the program coefficient from the author-conducted HLM analysis. For Clements and Sarama (2007), the mean differences were computed by the WWC and took into account pretest difference between the study groups. The resulting effect sizes may overestimate the intervention's effects when the intervention group had lower pretest scores than the comparison group and underestimate the intervention's effects when the intervention group had higher pretest scores than the comparison group.
6. For an explanation of the effect size calculation, see Technical Details of WWC-Conducted Computations.
7. Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups.
8. The improvement index represents the difference between the percentile rank of the average student in the intervention condition versus the percentile rank of the average student in the comparison condition. The improvement index can take on values between –50 and +50, with positive numbers denoting results favorable to the intervention group.

(continued)

9. The level of statistical significance was reported by the study authors or, where necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For an explanation about the clustering correction, see the WWC Tutorial on Mismatch. See Technical Details of WWC-Conducted Computations for the formulas the WWC used to calculate statistical significance. In the case of Clements and Sarama (2006), no corrections for clustering or multiple comparisons were needed.
10. The WWC-computed average effect sizes for each study and for the domain across studies are simple averages rounded to two decimal places. The average improvement indices are calculated from the average effect sizes.
11. In the case of Clements & Sarama (2007), corrections for clustering and multiple comparisons were needed, so the significance levels differ from those reported in the original study.

Appendix A4 Summary of findings for comparisons between *Building Blocks for Math* and *Pre-K Mathematics* for the math domain[1]

			Authors' findings from the study		WWC calculations			
			Mean outcome (standard deviation[2])					
Outcome measure	Study sample	Sample size (teachers/ children)[3]	*Building Blocks for Math* group[4]	*Pre-K Math* group[4]	Mean difference[5] (*Building Blocks for Math* – *Pre-K Math*)	Effect size[6]	Statistical significance[7] (at $\alpha = 0.05$)	Improvement index[8]
Clements & Sarama, 2006 (randomized controlled trial)[9]								
Early Mathematics Assessment	Preschool children	21/152	57.32 (7.46)	53.77 (6.53)	3.55	0.49	Statistically significant	+19
Domain average[10] for math						0.49	Statistically significant	+19

BBA = Building Blocks Assessment of Early Mathematics, PreK–K

1. This appendix presents findings for the head-to-head comparison of *Building Blocks for Math* and *Pre-K Mathematics* for a measure that falls in the math domain. *Pre-K Mathematics* was implemented in conjunction with an additional component (DLM Express software). Comparisons of *Building Blocks for Math* and the business-as-usual comparison group were used for rating purposes and are presented in Appendix A3.
2. The standard deviation across all students in each group shows how dispersed the participants' outcomes are: a smaller standard deviation on a given measure would indicate that participants had more similar outcomes. The standard deviations were provided by the study authors upon WWC request.
3. The child-level sample size was provided by the study authors upon WWC request.
4. The *Building Blocks for Math* group mean (57.32) equals the *Pre-K Mathematics* group mean (53.77) plus the program coefficient from the author-conducted HLM analysis (3.55).
5. Positive differences and effect sizes favor the *Building Blocks for Math* group; negative differences and effect sizes favor the *Pre-K Mathematics* group. The mean difference was the program coefficient from the author-conducted HLM analysis.
6. For an explanation of the effect size calculation, see Technical Details of WWC-Conducted Computations.
7. Statistical significance is the probability that the difference between groups is a result of chance rather than a real difference between the groups.
8. The improvement index represents the difference between the percentile rank of the average student in the *Building Blocks for Math* condition versus the percentile rank of the average student in the *Pre-K Mathematics* condition. The improvement index can take on values between –50 and +50, with positive numbers denoting results favorable to the *Building Blocks for Math* group.
9. The level of statistical significance was reported by the study authors or, where necessary, calculated by the WWC to correct for clustering within classrooms or schools and for multiple comparisons. For an explanation about the clustering correction, see the WWC Tutorial on Mismatch. See Technical Details of WWC-Conducted Computations for the formulas the WWC used to calculate statistical significance. In the case of Clements and Sarama (2006), no corrections for clustering or multiple comparisons were needed.
10. This row provides the study average, which in this instance, is also the domain average. The WWC-computed domain average effect size is a simple average rounded to two decimal places. The domain improvement index is calculated from the average effect size.

(continued)

Appendix A5 *Building Blocks for Math* rating for the math domain

The WWC rates an intervention's effects in a given outcome domain as positive, potentially positive, mixed, no discernible effects, potentially negative, or negative.[1]

For the outcome domain of math, the WWC rated *Building Blocks for Math* as having positive effects. The remaining ratings (potentially positive effects, mixed effects, no discernible effects, potentially negative effects, and negative effects) were not considered because *Building Blocks for Math* was assigned the highest applicable rating.

Rating received

Positive effects: Strong evidence of a positive effect with no overriding contrary evidence.

- Criterion 1: Two or more studies showing statistically significant *positive* effects, at least one of which met WWC evidence standards for a strong design.

  Met. Two studies of *Building Blocks for Math* showed statistically significant positive effects and both studies met WWC evidence standards for a strong design.

AND

- Criterion 2: No studies showing statistically significant or substantively important *negative* effects.

  Met. No studies showed statistically significant or substantively important negative effects.

1. For rating purposes, the WWC considers the statistical significance of individual outcomes and the domain-level effect. The WWC also considers the size of the domain-level effect for ratings of potentially positive or potentially negative effects. See the WWC Intervention Rating Scheme for a complete description.

Appendix A6 Extent of evidence by domain

		Sample size		
Outcome domain	Number of studies	Schools	Classrooms/children	Extent of evidence[1]
Oral language	0	0	0	na
Print knowledge	0	0	0	na
Phonological processing	0	0	0	na
Early reading/writing	0	0	0	na
Cognition	0	0	0	na
Math	2	4+	32/255	Small

na = not applicable/not studied

1. A rating of “moderate to large” requires at least two studies and two schools across studies in one domain, and a total sample size across studies of at least 350 students or 14 classrooms. Otherwise, the rating is “small.”